PEARSON EDEXCEL GCSE COMBINED SCIENCE (HIGHER) · 1SC0

CHEMISTRY



MARK SCHEME

TOPIC 0: FORMULAE, EQUATIONS AND HAZARDS (PAPER 2, PACK 2)

SCORE	PERCENTAGE
/83	%

STEMUP

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Mark Scheme

Q1.

Question Number	Answer	Additional guidance	Mark
(i)	C neutral (1)		(1)

Question Number	Answer	Mark
(ii)	An explanation that combines identification - application of knowledge (1 mark) and reasoning/justification - application of understanding (1 mark) • to react all the (nitric) acid in the solution (1) • so that the calcium nitrate solution is pure (1)	(2)

Question Number	Answer	Mark
(iii)	$CaCO_3 + 2HNO_3 \rightarrow Ca(NO_3)_2 + H_2O + CO_2$ (3) left hand side formulae (1) right hand side formulae (1) balancing correct formulae (1)	(3)

Q2.

Question Number	Answer	Mark
	An explanation that combines identification - application of knowledge (2 marks) and reasoning/justification - application of understanding (2 marks) • hydrochloric acid is (almost) fully dissociated into ions (1) • ethanoic acid is only slightly dissociated into ions (1) • but the concentration of acid in the hydrochloric acid is lower (1) • so the concentration of hydrogen ions in the hydrochloric acid is lower (1)	(4)

Q3.

Question Number	Answer	Acceptable answers	Mark
	$2Fe_2O_3 + 3C \rightarrow 4Fe + 3CO_2$ (3) lhs (1) rhs (1) balancing correct formulae (1)		**(3)**

Q4.

	Answer	**Acceptable answers**	**Mark**
	$Al^{3+} + 3OH^- \rightarrow Al(OH)_3$ OH^- (1) $Al(OH)_3$ (1) balancing 3, conditional on correct formulae (1)	allow multiples allow HO^- (1) allow $Al(HO)_3$ (1) do not allow $Al(HO)^3$/lower case h ignore state symbols/$3Na^+$ on both sides	**(3)**

Q5.

	Answer	Acceptable answers	Mark
	$Al^{3+} + 3OH^- \rightarrow Al(OH)_3$ OH^- (1) $Al(OH)_3$ (1) balancing 3, conditional on correct formulae (1)	allow multiples allow HO^- (1) allow $Al(HO)_3$ (1) do not allow $Al(HO)^3$/lower case h ignore state symbols/$3Na^+$ on both sides	**(3)**

Q6.

Question Number	Answer	Additional guidance	Mark
	$2H^+ + 2e^{(-)} \rightarrow H_2$ / $2H^+ \rightarrow H_2 - 2e^{(-)}$ (2) species in correct place as shown above (1) balancing of correct species in correct place (1)	allow use of = or ⇌ in place of → allow multiples reject h2 / h_2 / H2 / H^2	**(2)** AO 1 1

Q7.

	Answer	Acceptable answers	Mark
(a)(i)	an explanation linking the following • decomposition (of compound/substance /electrolyte)(1)	splitting up/breaking down/breaking up ignore separating reject splitting of	(2)

	• using (direct) current (1)	atoms/elements/molecules for M1 using {electrical energy /electricity} reject alternating current/ac	
(a)(ii)	• (damp blue) litmus (paper) (1) • (turns red then) {bleaches / goes white} (1)	allow bleaches indicator for 1 mark ignore indicator goes lighter ignore smells of chlorine/swimming pools ignore any incorrect middle colour mentioned use of suitable named indicator with correct result e.g. (damp) universal indicator paper (1) (turns red then) bleaches (1) starch-iodide paper(1) turns blue-black(1)	(2)
(a) (iii)	poly(chloroethene)	PVC/polyvinylchloride/ polychloroethene/poly(chlorethene)	(1)
(b)(i)	D AgCl(s)		(1)
(b)(ii)	same/no change		(1)
(b)(iii)	$HCl + AgNO_3 \rightarrow AgCl + HNO_3$ • reactant formulae (1) • product formulae (1)	$Ag^+ + Cl^- \rightarrow AgCl$ max 1 if any incorrect attempt to balance reject incorrect use of cases and non-subscripts	(2)

Q8.

	Answer	**Acceptable answers**	**Mark**
(a)(i)	an explanation linking the following • decomposition (of compound/substance /electrolyte)(1)	splitting up/breaking down/breaking up ignore separating reject splitting of atoms/elements/molecules for M1	(2)

	• using (direct) current (1)	using {electrical energy /electricity} reject alternating current/ac	
(a)(ii)	• (damp blue) litmus (paper) (1) • (turns red then) {bleaches / goes white} (1)	allow bleaches indicator for 1 mark ignore indicator goes lighter ignore smells of chlorine/swimming pools ignore any incorrect middle colour mentioned use of suitable named indicator with correct result e.g. (damp) universal indicator paper (1) (turns red then) bleaches (1) starch-iodide paper(1) turns blue-black(1)	(2)
(a) (iii)	poly(chloroethene)	PVC/polyvinylchloride/ polychloroethene/poly(chlorethene)	(1)
(b)(i)	D AgCl(s)		(1)
(b)(ii)	same/no change		(1)
(b)(iii)	$HCl + AgNO_3 \rightarrow AgCl + HNO_3$ • reactant formulae (1) • product formulae (1)	$Ag^+ + Cl^- \rightarrow AgCl$ max 1 if any incorrect attempt to balance reject incorrect use of cases and non-subscripts	(2)

Q9.

	Answer	**Acceptable answers**	**Mark**
(a)(i)	A carbonate ion CO_3^{2-}		**(1)**
(a)(ii)	A description including warm / heat / boil (1) {**gas/ammonia**} turns (damp red/pink) litmus blue / (damp red/pink) litmus turns blue when held above (the mixture)(1)	maximum (1) if additional reagents added ignore any ppt allow pungent smell / smell of {ammonia/wet nappies} /alkaline **gas** /effect of ammonia on other named indicators /dense white fumes with conc hydrochloric acid	**(2)**

		ignore litmus turns blue in ammonium ions/sodium hydroxide/mixture do not allow gas/ammonia if blue litmus turns red/pink	
(b)	$Al^{3+} + 3OH^- \rightarrow Al(OH)_3$ OH^- (1) $Al(OH)_3$ (1) balancing 3, conditional on correct formulae (1)	allow multiples allow HO^- (1) allow $Al(HO)_3$ (1) do not allow $Al(HO)^3$/lower case h ignore state symbols/$3Na^+$ on both sides	**(3)**

		Indicative Content	
QWC	***(c)**	An explanation including some of the following points **test for cation** • flame test • if the flame is yellow/not lilac, sodium ions are • if the flame is lilac/not yellow, potassium ions **test for iodide ions** • make a solution of the crystals in water • add dilute nitric acid • add silver nitrate solution • if there is a yellow precipitate, iodide ions are • if there is no precipitate, sulfate ions are prese • $Ag^+ + I^- \rightarrow AgI$ OR • make a solution of the crystals in water • add chlorine water • then cyclohexane • if the cyclohexane/top layer turns purple, iodic present • if there is no colour change, sulfate ions are pr • $Cl_2 + 2I^- \rightarrow 2Cl^- + I_2$ **test for sulfate ions** • make a solution of the crystals in water • add dilute {hydrochloric/nitric} acid • add barium {chloride/nitrate} solution • if there is a white precipitate, sulfate ions are • if there is no precipitate, iodide ions are prese • $Ba^{2+} + SO_4^{2-} \rightarrow BaSO_4$	
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description of test for any 1 ion e.g. flame test, yellow flame, sodium ions are present. • the answer communicates ideas using simple language and uses	

		limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description to identify a cation and an anion e.g. if the substance is sodium sulfate, it will give a yellow flame in a flame test and a white precipitate with barium chloride solution. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description to identify at least 3 ions e.g. carry out a flame test, yellow flame, sodium ions present, lilac flame, potassium ions present, add silver nitrate solution to solution of substance, yellow precipitate, iodide ion. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Q10.

	Answer	**Acceptable answers**	**Mark**
(a)(i)	A carbonate ion CO_3^{2-}		**(1)**
(a)(ii)	A description including warm / heat / boil (1) {**gas/ammonia**} turns (damp red/pink) litmus blue / (damp red/pink) litmus turns blue when held above (the mixture)(1)	maximum (1) if additional reagents added ignore any ppt allow pungent smell / smell of {ammonia/wet nappies} /alkaline **gas** /effect of ammonia on other named indicators /dense white fumes with conc hydrochloric acid ignore litmus turns blue in ammonium ions/sodium hydroxide/mixture do not allow gas/ammonia if blue litmus turns red/pink	**(2)**
(b)	$Al^{3+} + 3OH^- \rightarrow Al(OH)_3$ OH^- (1) $Al(OH)_3$ (1) balancing 3, conditional on correct formulae (1)	allow multiples allow HO^- (1) allow $Al(HO)_3$ (1) do not allow $Al(HO)^3$/lower case h ignore state symbols/$3Na^+$ on both sides	**(3)**

		Indicative Content	
QWC	***(c)**	An explanation including some of the following points	

		test for cation • flame test • if the flame is yellow/not lilac, sodium ions are • if the flame is lilac/not yellow, potassium ions **test for iodide ions** • make a solution of the crystals in water • add dilute nitric acid • add silver nitrate solution • if there is a yellow precipitate, iodide ions are • if there is no precipitate, sulfate ions are prese • $Ag^{+} + I^{-} \rightarrow AgI$ OR • make a solution of the crystals in water • add chlorine water • then cyclohexane • if the cyclohexane/top layer turns purple, iodic present • if there is no colour change, sulfate ions are pr • $Cl_2 + 2I^{-} \rightarrow 2Cl^{-} + I_2$ **test for sulfate ions** • make a solution of the crystals in water • add dilute {hydrochloric/nitric} acid • add barium {chloride/nitrate} solution • if there is a white precipitate, sulfate ions are • if there is no precipitate, iodide ions are prese • $Ba^{2+} + SO_4^{2-} \rightarrow BaSO_4$	

Level	**0**	No rewardable content
1	**1 - 2**	• a limited description of test for any 1 ion e.g. flame test, yellow flame, sodium ions are present. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy
2	**3 - 4**	• a simple description to identify a cation and an anion e.g. if the substance is sodium sulfate, it will give a yellow flame in a flame test and a white precipitate with barium chloride solution. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	**5 - 6**	• a detailed description to identify at least 3 ions e.g. carry out a flame test, yellow flame, sodium ions present, lilac flame, potassium ions present, add silver nitrate solution to solution of substance, yellow precipitate, iodide ion. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Q11.

Question Number	Answer	Acceptable answers	Mark
(i)	A description linking • blue (1) • precipitate / solid (1) Marked independently. If further, incorrect observations given, use list principle	 allow appropriate qualifiers: e.g. 'light blue' but **not** other colours eg green-blue allow ppt	**(2)**

Question Number	Answer	Acceptable answers	Mark
(ii)	$Cu^{2+} + 2OH^- \rightarrow Cu(OH)_2$ (3) Identifies Cu^{2+} on **LHS <u>and</u>** $Cu(OH)_2$ on **RHS** in equation format (1) OH^- formula on **LHS** (1) These two marks are independent and can be scored even if additional ions, correct or incorrect, are given balancing correct symbols (1) This mark is only awarded for a fully correct ionic equation with no additional ions	allow multiples accept $Cu^{2+}(OH^-)_2$ allow Cu^{++}/ Cu^{+2} reject incorrect symbols such as cu^{2+}, Oh^- etc. ignore: state symbols allow = instead of →	**(3)**

Q12.

Question Number	Answer	Acceptable answers	Mark
(i)	A description linking • blue (1) • precipitate / solid (1) Marked independently. If further, incorrect observations given, use list principle	 allow appropriate qualifiers: e.g. 'light blue' but **not** other colours eg green-blue allow ppt	**(2)**

Question Number	Answer	Acceptable answers	Mark
(ii)	$Cu^{2+} + 2OH^- \rightarrow Cu(OH)_2$ (3) Identifies Cu^{2+} on **LHS <u>and</u>** $Cu(OH)_2$ on **RHS** in equation format (1) OH^- formula on **LHS** (1) These two marks are independent and can be scored even if additional ions, correct or incorrect, are given balancing correct symbols (1) This mark is only awarded for a fully correct ionic equation with no additional ions	allow multiples accept $Cu^{2+}(OH^-)_2$ allow Cu^{++}/ Cu^{+2} reject incorrect symbols such as cu^{2+}, Oh^- etc. ignore: state symbols allow = instead of →	**(3)**

Q13.

Question number	Answer	Mark
	$Mg + 2HCl \rightarrow MgCl_2 + H_2$ LHS (1) RHS (1)	**(2)**

Q14.

Question Number	Answer	Acceptable answers	Mark
(a)	**D** aq l		**(1)**

Question Number	Answer	acceptable answers	Mark
(b)	$H^+ + OH^-$ (1) → H_2O (1)	LHS (1) RHS (1) ignore state symbols, even if incorrect. allow inclusion of spectator ions, Na^+ and Cl^-, if shown on both sides for one mark max	**(2)**

Question Number	Answer	Acceptable answers	Mark
(c)(i)	suitable acid-base indicator eg methyl orange, phenolphthalein	litmus reject universal indicator allow recognisable phonetic spelling	**(1)**

Question Number	Answer	Acceptable answers	Mark
(c)(ii)	correct colour change for suitable indicator in 4(c)(i): methyl orange : yellow → orange/pink/red phenolphthalein : magenta/pink → colourless	 litmus : blue → red ignore clear	**(1)**

Question Number	Answer	Acceptable answers	Mark
(d)	rel mass NaOH = 23.0 + 16.0 + 1.00 (1) concentration = $\frac{20.0}{\text{formula mass}}$ x 1 (1)	(= 40.0) (1) 0.5 (mol dm^{-3}) without working (2)	**(2)**

Question Number	Answer	Acceptable answers	Mark
(e)	moles of NaOH = $\frac{25.0 \times 1.50}{1000}$ (1) (= 0.0375 moles) ratio 1 : 1 / moles NaOH = moles HCl (1) conc of HCl = $\frac{0.0375 \times 1000}{30.0}$ (1) (= 1.25 (mol dm^{-3})) OR 25.0 x 1.50 = 30.0 x conc acid (2) conc of HCl = $\frac{25.0 \times 1.50}{30.0}$ (1) (=1.25 (mol dm^{-3}))	0.0375 (1) – without working shown conc of HCl = 1.25 (mol dm^{-3})(3) without any working shown allow ecf conc = $\frac{30.0 \times 1.50}{25.0}$ = 1.80 (2) (mol dm^{-3}) allow 0.00125 /0.125 / 12.5 max 2	**(3)**

Q15.

Question Number	Answer	Acceptable answers	Mark
(a)	**D** aq l		**(1)**

Question Number	Answer	acceptable answers	Mark
(b)	$H^+ + OH^-$ (1) → H_2O (1)	LHS (1) RHS (1) ignore state symbols, even if incorrect. allow inclusion of spectator ions, Na^+ and Cl^-, if shown on both sides for one mark max	**(2)**

Question Number	Answer	Acceptable answers	Mark
(c)(i)	suitable acid-base indicator eg methyl orange, phenolphthalein	litmus reject universal indicator allow recognisable phonetic spelling	**(1)**

Question Number	Answer	Acceptable answers	Mark
(c)(ii)	correct colour change for suitable indicator in 4(c)(i): methyl orange : yellow → orange/pink/red phenolphthalein : magenta/pink → colourless	 litmus : blue → red ignore clear	**(1)**

Question Number	Answer	Acceptable answers	Mark
(d)	rel mass NaOH = 23.0 + 16.0 + 1.00 (1) concentration = $\frac{20.0}{\text{formula mass}}$ x 1 (1)	(= 40.0) (1) 0.5 (mol dm^{-3}) without working (2)	**(2)**

Question Number	Answer	Acceptable answers	Mark
(e)	moles of NaOH = $\frac{25.0 \times 1.50}{1000}$ (1) (= 0.0375 moles) ratio 1 : 1 / moles NaOH = moles HCl (1) conc of HCl = $\frac{0.0375 \times 1000}{30.0}$ (1) (= 1.25 (mol dm^{-3})) OR 25.0 x 1.50 = 30.0 x conc acid (2) conc of HCl = $\frac{25.0 \times 1.50}{30.0}$ (1) (=1.25 (mol dm^{-3}))	0.0375 (1) – without working shown conc of HCl = 1.25 (mol dm^{-3})(3) without any working shown allow ecf conc = $\frac{30.0 \times 1.50}{25.0}$ = 1.80 (2) (mol dm^{-3}) allow 0.00125 /0.125 / 12.5 max 2	**(3)**

Q16.

Question Number	Answer	Acceptable answers	Mark
(a)	B potassium and caesium, copper and iron		**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)(i)	A description linking (regular arrangement of) positive ions /cations (1) (surrounded by) {delocalised/sea of} electrons (1)	Any reference to molecules/molecular/intermolecular/covalent scores 0 marks overall metal ions reject "negative and positive particles" / positive atoms / protons ignore descriptions of atoms in rows/ layers of particles etc cloud of electrons ignore free	**(2)**

Question Number	Answer	Acceptable answers	Mark
(b)(ii)	An explanation linking M1 electrons (1) M2 move/flow (1) M2 dep on M1	 pass through / travel For M2: ignore free/delocalised (electrons) ignore electricity flows ignore (electrons) vibrate ignore carry/pass the current/charge	**(2)**

Question Number	Answer	Acceptable answers	Mark
(c)(i)	A description including any two from floats (1) moves (around) (1) effervescence / fizzing / bubbles (1) melts/changes to a ball shape (1) becomes smaller /disappears (1)	moves (around) on the surface (2) white smoke formed ignore gas/hydrogen given off dissolves / explodes Ignore: burns/catches fire/ignites/flame/sparks ignore addition of indicators	**(2)**

Question Number	Answer	Acceptable answers	Mark
(c)(ii)	$2Na + 2H_2O \rightarrow 2NaOH + H_2$ LHS (1) RHS (1) balancing of correct formulae(1)	NaHO ignore brackets around OH Use of lower case h, upper case A, lower case o, or use of superscripts or large numbers inside the formulae loses 1 mark only ignore state symbols	**(3)**

Q17.

Question Number	Answer	Acceptable answers	Mark
(a)	B potassium and caesium, copper and iron		**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)(i)	A description linking (regular arrangement of) positive ions /cations (1) (surrounded by) {delocalised/sea of} electrons (1)	Any reference to molecules/molecular/intermolecular/covalent scores 0 marks overall metal ions reject "negative and positive particles" / positive atoms / protons ignore descriptions of atoms in rows/ layers of particles etc cloud of electrons ignore free	**(2)**

Question Number	Answer	Acceptable answers	Mark
(b)(ii)	An explanation linking M1 electrons (1) M2 move/flow (1) M2 dep on M1	 pass through / travel For M2: ignore free/delocalised (electrons) ignore electricity flows ignore (electrons) vibrate ignore carry/pass the current/charge	**(2)**

Question Number	Answer	Acceptable answers	Mark
(c)(i)	A description including any two from floats (1) moves (around) (1) effervescence / fizzing / bubbles (1) melts/changes to a ball shape (1) becomes smaller /disappears (1)	moves (around) on the surface (2) white smoke formed ignore gas/hydrogen given off dissolves / explodes Ignore: burns/catches fire/ignites/flame/sparks ignore addition of indicators	**(2)**

Question Number	Answer	Acceptable answers	Mark
(c)(ii)	$2Na + 2H_2O \rightarrow 2NaOH + H_2$ LHS (1) RHS (1) balancing of correct formulae(1)	NaHO ignore brackets around OH Use of lower case h, upper case A, lower case o, or use of superscripts or large numbers inside the formulae loses 1 mark only ignore state symbols	**(3)**

Q18.

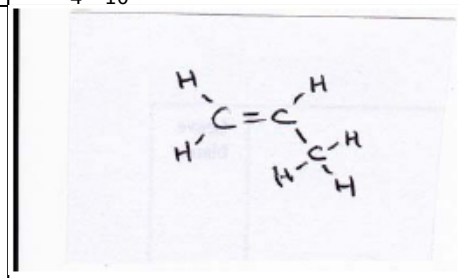
	Answer	**Acceptable answers**	**Mark**
	$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ • reactant formulae (1) • product formulae (1) • balancing of correct formulae (1)	accept multiples reject incorrect use of cases and non-subscripts	(3)

Q19.

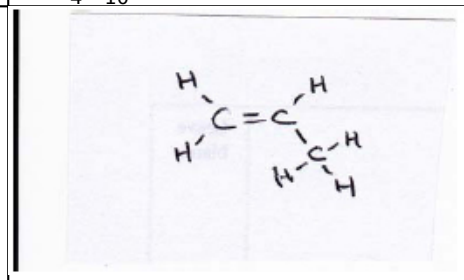
	Answer	**Acceptable answers**	**Mark**
	$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ • reactant formulae (1)	accept multiples	(3)

	• product formulae (1) • balancing of correct formulae (1)	reject incorrect use of cases and non-subscripts	

Q20.

	Answer	Acceptable answers	Mark
(a)(i)	D C_4H_{10}		**(1)**
(a)(ii)	 **one** C=C in a molecule with three consecutive carbon atoms (1) rest of structure correct, ignore bond angles, conditional on first marking point(1)	allow $-CH_3$ do not allow two C=C in a molecule allow (1) for completely correct dot and cross diagram	**(2)**
(b)	C oxidised		**(1)**
(c)(i)	A description including two from • effervescence / fizzing / bubbles of gas (1) • solid {disappears/clears} /(colourless)solution formed (1)	ignore {cloudy/white ppt} /'gas formed'/colour change /name of gas / changes to a liquid (solid/sodium carbonate/it) dissolves (1)	**(2)**
(c)(ii)	$CH_3COOC_2H_5$/$CH_3COOCH_2CH_3$/ $CH_3CO_2C_2H_5$ / $CH_3CO_2CH_2CH_3$ / $C_2H_5O_2CCH_3$ / $CH_3CH_2OOCCH_3$(1) H_2O (1)	allow displayed formulae/ $C_4H_8O_2$ do not allow formulae ending in –COOH/-COO or any formula that does not show an ester do not allow H2O / H^2O /lower case h/HOH maximum (1) if additional incorrect balancing ignore state symbols	**(2)**

Q21.

	Answer	Acceptable answers	Mark
(a)(i)	D C_4H_{10}		**(1)**
(a)(ii)	 **one** C=C in a molecule with three consecutive carbon atoms (1) rest of structure correct, ignore bond angles, conditional on first marking point(1)	allow -CH_3 do not allow two C=C in a molecule allow (1) for completely correct dot and cross diagram	**(2)**
(b)	C oxidised		**(1)**
(c)(i)	A description including two from • effervescence / fizzing / bubbles of gas (1) • solid {disappears/clears} /(colourless)solution formed (1)	ignore {cloudy/white ppt} /'gas formed'/colour change /name of gas / changes to a liquid (solid/sodium carbonate/it) dissolves (1)	**(2)**
(c)(ii)	$CH_3COOC_2H_5$/$CH_3COOCH_2CH_3$/ $CH_3CO_2C_2H_5$ / $CH_3CO_2CH_2CH_3$ / $C_2H_5O_2CCH_3$ / $CH_3CH_2OOCCH_3$(1) H_2O (1)	allow displayed formulae/ $C_4H_8O_2$ do not allow formulae ending in –COOH/-COO or any formula that does not show an ester do not allow H2O / H^2O /lower case h/HOH maximum (1) if additional incorrect balancing ignore state symbols	**(2)**

Q22.

Question Number	Answers	Acceptable Answers	Mark
(a)	<table><tr><th></th><th>relative mass</th><th>relative charge</th><th>position in atom</th></tr><tr><td>proton</td><td>1</td><td>(+1)</td><td>in nucleus</td></tr><tr><td>neutron</td><td>(1)</td><td>0</td><td>(in nucleus)</td></tr><tr><td>electron</td><td>1/1837</td><td>-1</td><td>in shells</td></tr></table> all 6 correct (3) 4 or 5 correct (2) 2 or 3 correct (1)	ignore units reject relative mass of proton: +1/1+ for relative mass of electron: anything smaller than 1/1500/0.00067 (almost) 0/negligible/very small for relative charge on neutron: none/no charge/neutral for position of electron in an atom: in orbits / orbitals / energy levels / around the nucleus /outside the nucleus ignore rings ignore inner/outer	**(3)**

Question Number	Answers	Acceptable Answers	Mark
(b)	D equal numbers of protons and electrons		**(1)**

Question Number	Answers	Acceptable Answers	Mark
(c)(i)	Ca	Reject CA / ca /cA ignore calcium	**(1)**

Question Number	Answers	Acceptable Answers	Mark
(c)(ii)	O	ignore any negative charge on the O ignore oxygen reject: oxide/O_2	**(1)**

Question Number	Answers	Acceptable Answers	Mark
(d)(i)	13	Allow correct working even if wrong answer	**(1)**

Question Number	Answers	Acceptable Answers	Mark
(d)(ii)	**D** AlN		**(1)**

Q23.

Question Number	Answers	Acceptable Answers	Mark
(a)	<table><tr><td></td><td>relative mass</td><td>relative charge</td><td>position in atom</td></tr><tr><td>proton</td><td>**1**</td><td>(+1)</td><td>**in nucleus**</td></tr><tr><td>neutron</td><td>(1)</td><td>**0**</td><td>(in nucleus)</td></tr><tr><td>electron</td><td>**1/1837**</td><td>**-1**</td><td>**in shells**</td></tr></table> all 6 correct (3) 4 or 5 correct (2) 2 or 3 correct (1)	ignore units reject relative mass of proton: +1/1+ for relative mass of electron: anything smaller than 1/1500/0.00067 (almost) 0/negligible/very small for relative charge on neutron: none/no charge/neutral for position of electron in an atom: in orbits / orbitals / energy levels / around the nucleus /outside the nucleus ignore rings ignore inner/outer	**(3)**

Question Number	Answers	Acceptable Answers	Mark
(b)	D equal numbers of protons and electrons		**(1)**

Question Number	Answers	Acceptable Answers	Mark
(c)(i)	Ca	Reject CA / ca /cA ignore calcium	**(1)**

Question Number	Answers	Acceptable Answers	Mark
(c)(ii)	O	ignore any negative charge on the O ignore oxygen reject: oxide/O_2	**(1)**

Question Number	Answers	Acceptable Answers	Mark
(d)(i)	13	Allow correct working even if wrong answer	**(1)**

Question Number	Answers	Acceptable Answers	Mark
(d)(ii)	**D** AlN		**(1)**

Q24.

Question number	Answer	Mark
(i)	C	**(1)**

Question number	Answer	Mark
(ii)	C	(1)

Q25.

	Answer	Acceptable answers	Mark
(i)	$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$ reactants (1) products (1)	Accept multiples If not correctly balanced max 1 Must be subscripts where relevant	(2)

			Indicative Content	
QWC		*(ii)	A description including some of the following points **general points** • reactions occur when particles collide • more frequent collisions cause higher rate of r • mass and size of zinc pieces same so no effect reaction • because same surface area • two factors have been altered in the same exp • cannot be certain of effect of each **concentration** • experiment 2 higher/triple concentration of ac • so more particles (in same volume) • so more frequent collisions between particles • more successful collisions **temperature** • experiment 2 higher temperature • particles move faster • particles have more energy • so more frequent collisions between particles rate) • more successful collisions • so more energetic collisions between particles • more particles have enough energy to react (a energy) when they collide	
Level	0	No rewardable content		
1	1 - 2	• a limited description e.g. temperature is higher and concentration is higher so reaction is faster e.g. temperature is higher so particles move faster so reaction is faster • the answer communicates ideas using simple language and uses		

		limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	a simple description e.g. temperature is higher so particles move faster and concentration is higher so more particles so reaction is faster eg when concentration is higher there will be more particles so more frequent collisions so faster reaction e.g. when temperature is higher particles move faster so more successful collisions so faster reaction • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description e.g. higher concentration of acid so more particles so more frequent collisions so faster reaction and higher temperature so particles have more energy so more successful collisions so faster reaction • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Q26.

	Answer	**Acceptable answers**	**Mark**
(i)	$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$ reactants (1) products (1)	Accept multiples If not correctly balanced max 1 Must be subscripts where relevant	**(2)**

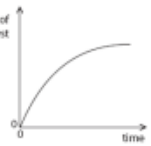
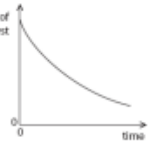
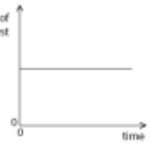
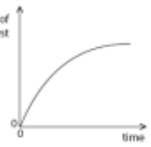
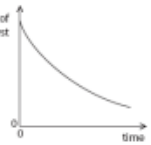
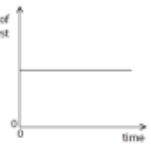
		Indicative Content	
QWC	***(ii)**	A description including some of the following points **general points** • reactions occur when particles collide • more frequent collisions cause higher rate of r • mass and size of zinc pieces same so no effect reaction • because same surface area • two factors have been altered in the same exp • cannot be certain of effect of each **concentration**	

		• experiment 2 higher/triple concentration of ac • so more particles (in same volume) • so more frequent collisions between particles • more successful collisions **temperature** • experiment 2 higher temperature • particles move faster • particles have more energy • so more frequent collisions between particles rate) • more successful collisions • so more energetic collisions between particles • more particles have enough energy to react (a energy) when they collide	
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description e.g. temperature is higher and concentration is higher so reaction is faster e.g. temperature is higher so particles move faster so reaction is faster • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	a simple description e.g. temperature is higher so particles move faster and concentration is higher so more particles so reaction is faster eg when concentration is higher there will be more particles so more frequent collisions so faster reaction e.g. when temperature is higher particles move faster so more successful collisions so faster reaction • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description e.g. higher concentration of acid so more particles so more frequent collisions so faster reaction and higher temperature so particles have more energy so more successful collisions so faster reaction • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Q27.

Question Number	Answer	Acceptable answers	Mark
(a)	A use hydrochloric acid which is more dilute		**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)	An explanation linking two of M1 {particles/reactants/collisions} have more energy (1) M2 more frequent collisions (1) M3 more {productive/successful/effective} collisions (1)	 atoms/ions/molecules as alternatives to particles reject electrons particles move faster more collisions per unit time ignore collisions are more likely/greater chance/probability of collisions/faster collisions more particles have required activation energy	**(2)**

Question Number	Answer	Acceptable answers	Mark
(c)(i)	**C** ☐ A  ☐ B  ☐ C  ☐ D  ☐ A  ☐ B  ☐ C  ☐ D 		**(1)**

Question Number	Answer	Acceptable answers	Mark
(c)(ii)	$2H_2O_2 \rightarrow 2H_2O + O_2$ (2) all formulae correct (1) balancing correct formulae (1)	multiples or halves reject other reactants or products ignore heat on arrow or elsewhere ignore state symbols ignore use of lower case h, lower case o, or use of superscripts or large numbers inside the formulae	**(2)**

Question Number	Answer	Acceptable answers	Mark
(d)	An explanation linking M1 energy needed to break bonds / energy released when bonds formed (1) M2 more heat / energy is released than needed (1) M2 dependent on scoring M1	bond breaking is endothermic / bond making is exothermic if any contradictory statements made in M1, the mark cannot be awarded (and so M2 cannot be awarded either) ignore numbers of bonds eg more bonds formed than broken "more energy is released forming bonds than needed to break bonds" (2)	**(2)**

Q28.

	Answer	Acceptable answers	Mark
	$C_2H_4 + H_2o \rightarrow C_2H_5OH$ C_2H_4 as **reactant** (1) rest of equation correct conditional on C_2H_4 as a reactant (1)	do not allow H2O / H^2O / lower case h/HOH allow C_2H_6O for ethanol ignore state symbols	**(2)**

Q29.

	Answer	Acceptable answers	Mark
	$C_2H_4 + H_2o \rightarrow C_2H_5OH$ C_2H_4 as **reactant** (1)	do not allow H2O / H^2O / lower case h/HOH	

	rest of equation correct conditional on C_2H_4 as a reactant (1)	allow C_2H_6O for ethanol ignore state symbols	**(2)**

Q30.

Question Number	Answer	Mark
(i)	**B** -78 -33 does not conduct **The only correct answer is B** ***A*** *is not correct because simple molecular, covalent substances do not have high mpt and bpt* ***C*** *is not correct because ammonia is a gas at room temperature and does not conduct* ***D*** *is not correct because simple molecular, covalent substances do not have these properties*	**(1)** AO 2 1

Question Number	Answer	Additional guidance	Mark
(ii)	$N_2 + 3H_2 \rightarrow 2NH_3$ (2) left hand side formulae (1) balancing of correct formulae (1)	accept multiples allow = or ⇌ in place of → ignore state symbols even if incorrect do not allow N2, n2, etc	**(2)** AO 2 1